STATE OF CALIFORNIA
EARL WARREN, Governor
DEPARTMENT OF NATURAL RESOURCES
WARREN T. HANNUM, Director

DIVISION OF MINES
Ferry Building, San Francisco 11
OLAF P. JENKINS, Chief

MINERAL INFORMATION SERVICE

VOL. 4 September 1, 1951 No. 9

MINERAL INFORMATION SERVICE is a monthly news release concerning the mineral resources and industry of CALIFORNIA, designed to inform the public of the discoveries, operations, markets, statistics, and new publications. It is distributed without cost upon request.

PETROLEUM

The first well to be drilled for oil in California was completed in 1865, just fifteen years after the famous Drake well was drilled in Pennsylvania. Since then the State of California has held a leading place among the oil producing states of the nation, and is currently the second largest producer. Petroleum is the most important industry in the state with the single exception of agriculture. To the end of 1950 the cumulative production of crude oil in California amounted to more than $8\frac{1}{2}$ billion barrels.

Origin of Petroleum. Important petroleum resources have been found only in certain restricted areas of the state. The reason for this is not accidental, but is related to the origin and accumulation of petroleum and to the geologic history of the state. The origin of petroleum is a subject that has occasioned much controversy, but it is now generally conceded that petroleum is formed from marine organisms that were buried in shallow-water marine sediments in past geologic ages. Studies of both ancient and recent marine sediments have revealed a much higher organic content in fine-grained sediments than in coarser clastics. Therefore, highly organic marine shales are commonly considered to be the most likely petroleum source rocks. The processes by which this buried organic matter is turned into petroleum is not completely understood, but undoubtedly such factors as bacterial action, depth of burial, temperature, pressure, and perhaps radioactivity, are contributing causes. The fact that important accumulations of petroleum have been found only in regions that contain significant volumes of unmetamorphosed marine sediments testifies to the soundness of our theories concerning the origin of petroleum.

Migration of Petroleum. After formation petroleum must migrate to and be trapped in a permeable and porous reservoir rock before a potential oil field can be said to exist. It is generally thought that migration takes place in the following manner. As the source rock is buried deeper and is compacted petroleum is squeezed out of the relatively impermeable shale and forced into more permeable rock such as sandstone. The permeable stratum will be saturated with water so that a gravitational separation between water and petroleum will gradually be effected with the petroleum floating on top of the water. In addition, the permeable bed will be subjected to differential hydraulic and rock pressures so that there will be a lateral movement of water and petroleum within the stratum. Under these conditions a concentration of petroleum ultimately results if a suitable trap exists. Petroleum does not exist in vast underground caverns but is found in cracks and fissures and most commonly in the pore

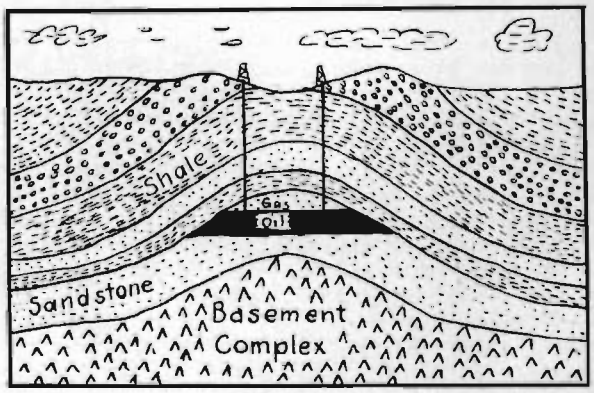

Figure 1.

spaces between the grains of sedimentary rocks. A "solid" sandstone often has a porosity of 30 to 40 percent.

Traps. A trap is any combination of geologic features that will stop the upward and lateral migration of petroleum and allow it to collect into "pools". A trap may be the result of stratigraphic conditions, structural deformation, or a combination of the two. The classical and most widely known type of trap is the closed anticline. This is a dome-like upward flexure of a sedimentary bed that provides a pocket for the gravitational accumulation